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NATIONAL COMMUNICATIONS FROM PARTIES INCLUDED IN ANNEX I TO THE CONVENTION

ANNUAL INVENTORIES OF NATIONAL GREENHOUSE GAS DATA FOR 1996

Report on national greenhouse gas emissions inventory submissions from Annex I Parties for 1990 to 1996

Note by the secretariat

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I. INTRODUCTION

A. Mandate

1. By its decision 6/CP.3, the Conference of the Parties (COP) requested the secretariat to collect, process and publish, on a regular basis, national greenhouse gas (GHG) inventories submitted annually by Annex I Parties in accordance with decision 9/CP.2.[1] The submission of national inventory data was due by 15 April 1998. The Subsidiary Body for Implementation (SBI), at its ninth session, requested the secretariat to provide a report on the information contained in national inventory submissions for the tenth session of the subsidiary bodies; and also requested the secretariat to include in that report the available projection data (FCCC/SBI/1998/7, para. 21 (f)).

2. The compilation of inventory information has been carried out in accordance with the revised guidelines for the preparation of national communications by Parties included in Annex I to the Convention (decision 9/CP.2), which are also to be applied for the preparation of annual GHG inventories (decision 3/CP.1). Relevant COP decisions and conclusions of the subsidiary bodies dealing with the reporting of GHG emission inventories adopted subsequent to decision 9/CP.2 have also been taken into account.

B. Scope of the note

3. This report contains data on GHG emissions and removals for the period 1990-1996, or the year 1996, provided in the annual submissions of greenhouse gas inventories by 26 Annex I Parties, of which six are Parties with economies in transition.[2] Data on projections provided in second national communications have been included for all 26 Parties considered in this report. Numerical data on inventories and projections are included in the tables contained in the addendum to this report, document FCCC/SBI/1999/5/Add.1. This report only provides information from the annual submissions which were due in April 1998, and does not provide information from earlier submissions where not reported in the annual submission. The most up-to-date and complete information on inventory data submitted by Parties, including information from earlier submissions for those Parties which did not submit information in 1998, will be available on the official UNFCCC Web site in June 1999.

4. This document also describes the status of reporting of annual GHG emission inventories, in particular the timeliness of reporting and completeness of the data reported. Annual inventory data should have been included in the compilation and synthesis of national communications (decision 6/CP.3) which was prepared for the Conference of the Parties at its fourth session in November 1998 (FCCC/CP/1998/11 and Add.1 and 2). The secretariat was unable to do so, as only four Annex I Parties had submitted their national greenhouse gas inventories by the due date

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[1] For the full texts of decisions adopted by the Conference of the Parties at its first, second and third sessions, see documents FCCC/CP/1995/7/Add.1, FCCC/CP/1996/15/Add.1 and FCCC/CP/1997/7/Add.1, respectively.

[2] Romania submitted its second national communication in February 1999 and requested it to be considered as its inventory submission for the purpose of this report and in response to decision 6/CP.3.

of 15 April 1998. The SBI, at its eighth session, noted that the secretariat would provide a report to the SBI at its ninth session based on data submitted by 30 September 1998 (FCCC/SBI/1998/6, para. 24(c)). By 15 October 1998 only 21 Annex I Parties had submitted their data, and a summary report was prepared by the secretariat (FCCC/CP/1998/INF.9), with the intention that a full report would be prepared for the tenth session of the subsidiary bodies. By 15 March 1999 26 Annex I Parties had submitted the inventory data due by 15 April 1998.

C. Possible action by the SBI

5. The SBI may wish to:

(a) Note that although many Parties have submitted annual GHG emission inventory data for the period 1990-1996, which were due by 15 April 1998, several Parties have not done so;

(b) Discuss the reasons for the delay and incompleteness of reporting and request Parties to indicate in their annual submissions any difficulties being encountered in providing timely and complete inventory data;

(c) Request those Parties which have not submitted inventory data due in 1998 to include the required information for the period 1990-1997 in their 1999 submissions;

(d) Urge all Parties to provide greenhouse gas emission inventories electronically and in the agreed format for all years for which data are provided.

6. The SBI may also wish to note the ongoing work in the Subsidiary Body for Scientific and Technological Advice (SBSTA) on the revised text of the UNFCCC guidelines for reporting inventory data by Annex I Parties (FCCC/SBSTA/1999/INF.1/Add.1 and FCCC/SB/1999/1), aimed at facilitating technical analysis of the data and emission patterns, including revision of previously submitted data through more transparent reporting.

II. STATUS OF REPORTING

A. Timing of submissions

7. Only four Parties submitted their national GHG inventories by the due date, 15 April 1998, and 22 more Parties submitted the inventory information by 15 March 1999 (see box 1).

Box 1. Timing of inventory submissions[3]

Timing	Parties
by 15 April 1998	Ireland, Netherlands, Switzerland, United Kingdom
by 15 July 1998	Austria, Czech Republic, Denmark, Germany, Latvia, New Zealand, Norway, Sweden
by 15 October 1998	Australia, Belgium, Canada, France, Greece, Japan, Monaco, Slovakia, United States of America
by 15 January 1999	Poland
since 15 January 1999	Finland, Hungary, Romania, Spain
Not received	Bulgaria, Estonia, Iceland, Italy, Lithuania, Luxembourg, Portugal, Russian Federation, Ukraine, European Community

B. Status of submissions in electronic form

8. Sixteen of the 26 reporting Parties provided the inventory information in electronic form (see box 2). However, not all Parties followed the reporting format (see annex). Alteration of the requested format, e.g. by exclusion or addition of rows or columns, hampers the processing of the data.

Box 2. Status of submissions in electronic form

Status	Parties
In electronic form	Australia, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Japan, Monaco, New Zealand, Norway, Romania, Sweden, Switzerland, United Kingdom, United States of America
Hard copy only	Austria, Canada, Finland, Greece, Ireland, Latvia, Netherlands, Poland, Slovakia, Spain

C. Completeness

9. Fourteen Parties provided data for the years 1990 to 1996. Romania and Spain only reported data up to 1994 and 1995, respectively, which have been included in this report as they were reported as their annual submission of national inventory data due by 15 April 1998.[4]

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[3] By decision 4/CP.3, Croatia, the Czech Republic, Liechtenstein, Monaco, Slovakia and Slovenia were included in the list in Annex I to the Convention in accordance with Article 4.2(f). The amendments to the list of Annex I Parties had not entered in force by 15 April 1998, the due date for submitting the national GHG inventory data. The Czech Republic, Monaco and Slovakia have submitted their national GHG emission inventories for 1996, which have been included in this document.

[4] Finland, Germany and the United States of America provided preliminary data for 1997 also.

Box 3. Years covered in annual inventories

1990-1996	1996	1995 and 1996	Other period
Australia, Austria, Belgium, Canada, France, Germany, Greece, Japan,[a] Monaco, Netherlands, New Zealand, Norway, United Kingdom, United States of America	Czech Republic, Denmark, Latvia, Poland, Sweden, Switzerland	Ireland, Slovakia[b]	Hungary: 1991 to 1996 Finland: 1990, 1995 and 1996 Romania: 1989 to 1994 Spain: 1990 to 1995

[a] Japan provided 1996 estimates only for CO_2 and HFCs, PFCs and SF_6, and no estimates for CH_4 and N_2O.
[b] Slovakia provided emission estimates for some source categories for 1990 to 1994, which have not been considered in this report due to the incompleteness of those data.

10. Parties which did not report a full set of data for the entire period 1990-1996 (see box 3) did not make any indications as to the methodological consistency of the estimates with previously reported inventories, such as second national communications. These Parties have therefore not been included in the analysis of GHG emission trends.

11. All 26 Parties provided estimates for carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). With respect to reporting of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6), seven Parties did not provide any estimates of these gases, and four Parties provided information for one or two of them only (see table 1). The requirement to report precursor gases (carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOCs)[5] was followed by all Parties except Finland. Estimates of aggregate GHG emissions in CO_2 equivalent were provided by 11 Parties,[6] using 1995 IPCC global warming potential (GWP) values;[7] however, disaggregation levels and formats used for their reporting varied among Parties.

D. Comparability

12. Fourteen Parties included in their submission the summary table of the Revised 1996 IPCC Guidelines.[8] The other 12 Parties used category classifications from earlier IPCC guidelines, or reported specific source categories at a more disaggregated level than required in the summary table, or structured them differently.

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[5] Current UNFCCC guidelines encourage Parties to provide data on sulphur dioxide (SO_2), which was included by all Parties except Finland, Hungary, Poland and Sweden.

[6] Australia, Austria, Belgium, Finland, France, Germany, Greece, Latvia, Netherlands, Norway and Romania.

[7] Romania used 1994 IPCC GWP values with a 100-year time horizon.

[8] For estimating and reporting emissions and removals of GHGs, Parties should use the Revised 1996 Guidelines for National Greenhouse Gas Inventories, as was reaffirmed by decision 2/CP.3. These Guidelines request the reporting of the inventory data in summary and sectoral tables and worksheets.

Box 4. Formats used for the reporting of inventory data

	Use of the 1996 IPCC format			Summary table according to the previous (1995) IPCC format	Other structure of summary table[a]
	Summary table	Sectoral table	Overview table		
Reporting Parties	Australia, Belgium, Canada, Czech Republic, Denmark, France, Germany, Greece, Japan, New Zealand, Norway, Poland, United Kingdom, United States of America[b]	Australia, Belgium, Canada, Czech Republic, Denmark, France, Greece, Japan, New Zealand, Norway, Switzerland, United Kingdom, United States of America[b]	Australia, Canada, Finland, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States of America[b]	Finland, Ireland, Slovakia,[c] Spain, Sweden, Switzerland, Romania[c]	Austria, Hungary, Latvia, Monaco, Netherlands

[a] Other structures are e.g. tables which are organized by trends of individual gases, or tables where individual source categories have been included.
[b] Inventory data in the 1996 IPCC format were provided for the year 1996 only.
[c] Parties with economies in transition are allowed to phase in the Revised 1996 Guidelines one year later than other Annex I Parties, but not later than for the inventories due in 1999, as decided by the SBSTA at its fourth session (FCCC/SBSTA/1996/20, para.30(a)).

13. Notation keys (NE, NO, IE)[9] to explain blanks in summary and /or sectoral tables were used by only nine Parties.[10] The IPCC overview table regarding completeness and the quality of estimates was submitted by nine of the 26 reporting Parties[11] (see annex).

E. Reporting of HFCs, PFCs and SF_6

14. Parties used different approaches (actual/potential)[12] for reporting emissions of HFCs, PFCs and SF_6. Formats used for the reporting of these gases also varied. In some cases these formats did not provide a clear indication as to whether the reported data represented actual or potential emissions. Only about half of the Parties providing estimates of these gases reported them in a disaggregated way by different gas species[13] (see table 1).

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9 NE = not estimated, NO = not occurring, IE = estimated but included elsewhere.

10 Australia, Finland, Germany, Hungary, New Zealand, Norway, Sweden, the United Kingdom and the United States of America.

11 Blanks in summary and/or sectoral tables are often not explained by Parties, e.g. by indicating whether a certain source category does not occur in the country, or has not been estimated.

12 When reporting emissions of HFCs, PFCs and SF_6, Parties should report actual emissions, as was affirmed by decision 2/CP.3. The 1996 IPCC reporting format facilitates the distinction between actual and potential emissions. However, some Parties noted difficulties in reporting actual emissions and therefore reported potential emissions only, or reported actual emissions for one type of gas and potential emissions for the other gases (see table 1).

13 For those Parties reporting aggregate emissions of HFCs and PFCs in full mass units (Gg) only, the secretariat had to make assumptions as to the species of the gases when converting emissions to CO_2 equivalent. This can introduce significant inaccuracies to a Party's aggregate GHG emissions, due to the high and very specific GWP values of these substances.

Table 1. Information provided by Parties on emissions of HFCs, PFCs and SF_6

Party	Reporting of actual (A) and/ or potential (P) emissions			Disaggregation by gas species	Units: full mass (Gg) / CO_2 equivalent (Gg)	Period / years
	HFCs	PFCs	SF_6			
Australia[a]	-	A	A	X	mass	1990-1996
Austria	P	P	P	-	mass	1995 and 1996
Belgium[b]	A	A and P	A and P	X	mass and CO_2 equivalent	1990 and 1996
Canada	A and P	A	A and P	-	CO_2 equivalent	1990-1996
Czech Republic	A	A	A	-	mass	1996
Denmark	A	A	A	-	mass	1996
Finland	P	NO	P	-	mass and CO_2 equivalent	1990, 1995 and 1996
France	A	A	A	X	mass and CO_2 equivalent	1990-1996
Germany	A	A	A	X (for PFCs)	mass	1990-1996
Greece[a]	A	A	-	-	mass and CO_2 equivalent	1990-1996
Hungary	-	-	-	-	-	-
Ireland	-	-	-	-	-	-
Japan	P	P	P	-	mass	1990-1996
Latvia	-	-	-	-	-	-
Monaco	-	-	-	It was stated that emissions of these substances were negligible		
Netherlands	A	A	P	X	mass and CO_2 equivalent	1990-1996
New Zealand	P	A and P	P	X	mass	1990-1996
Norway	P	A	P	X	mass	1990-1996
Poland	A and P	A and P	-	-	mass	1996
Romania	-	-	-	-	-	-
Slovakia	-	A	-	X	mass	1996
Spain	-	-	-	-	-	-
Sweden	-	-	-	-	-	-
Switzerland[b]	A and P	A and P	A and P	X	mass	1996
United Kingdom	A and P	A and P	A and P	-	mass	1990-1996
United States of America	A	A	A	X	mass	1990-1996

[a] Lack of reporting due to unavailability of data.

[b] The Party indicated that estimates are preliminary.

F. Land-use change and forestry

15. Reporting of emissions from the land-use change and forestry sector has improved. However, four Parties, Finland, Greece, Monaco and Spain, did not include any estimates for this sector in their national inventories.[14] Regarding the level of disaggregation, all Parties indicated at a minimum the subsector of their CO_2 land-use change and forestry emissions and removals, and roughly one third of the Parties followed the disaggregation level of the IPCC sectoral table. The IPCC worksheets for land-use change and forestry, standard data tables or equivalent documentation were provided by only seven Parties[15] (see annex). Non-CO_2 gases from the land-use change and forestry sector were not reported by six Parties;[16] emissions of these gases were reported under the subsector 'other' land-use change and forestry activities and/or under 'forest and grassland conversion'.

G. Changes in the base year inventory

16. As a consequence of improvements in and updating of methodologies, Parties recalculated their base year and subsequent inventory data. This was also noted when comparing emission estimates provided in second national communications with those provided in first national communications.[17] All 16 Parties which reported emission estimates for 1990 in their annual inventory submission, with the exception of Belgium and Spain, revised their estimates for 1990 in relation to those provided in their second national communications. Gases and sectors affected by the revision varied; the most significant changes in estimates were noted in N_2O emissions, mainly as a consequence of including source categories not previously considered, such as N_2O emissions from agriculture (manure management and agricultural soils) in accordance with the Revised 1996 IPCC Guidelines. The range of changes in greenhouse gas emissions inventories is shown in table 2.

17. The approaches used by Parties to report information on revisions of emission estimates differed. Three Parties[18] did not provide any explanation for their revisions of earlier estimates, while other Parties[19] dedicated a separate section in their submission to this issue, indicating the revised sectors and gases and the underlying reason for revision. In other cases general statements as to the revision of the data were made in the reports, but in such cases the relevant information was difficult to elicit, which reduced the transparency of the inventory.

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[14] Finland and Greece provided some preliminary figures for this sector in their reports.

[15] Australia, Hungary, New Zealand, Slovakia, Sweden, Switzerland and the United Kingdom.

[16] Netherlands, Romania, Sweden, Switzerland, the United Kingdom and the United States of America.

[17] For further information on recalculation of the base year inventory between first and second national communications, see document FCCC/SBSTA/1998/7.

[18] Germany, Japan and Romania.

[19] Australia, Greece, Netherlands, New Zealand, the United Kingdom and the United States of America.

Table 2. Changes in 1990 GHG emission inventories between second national communications and most recent inventory submissions

Parties which revised their 1990 inventory	Percentage change[a]				Main reasons, sectors, gases[b]
	Aggregate GHG	CO_2	CH_4	N_2O	
Australia	1	1	4	-5	Fuel combustion /energy industries: EF Fugitive fuels: M Agriculture (N_2O): NS, M Land-use change and forestry: M, AD
Austria	-1	0	0	-21	Fuel combustion /transport (N_2O): EF Waste/incineration (CO_2): EF
Canada	6	-1	3	121	Agriculture (CH_4, N_2O): M, NS, EF Industrial processes: NS
Finland	12	10	46	3	Fuel combustion: EF Revisions according to 1996 IPCC Guidelines
France	10	3	0	70	Revisions according to 1996 IPCC Guidelines
Germany	0	0	-3	0	Not reported
Greece	5	1	-1	73	Revisions according to 1996 IPCC Guidelines Fuel combustion (transport): AD Agriculture: EF
Japan	-1	0	-2	-42	Not reported
Netherlands	1	-4	17	25	Fuel combustion (energy, industry, transport) (CO_2): EF, M Industrial processes/Chemical industries (N_2O): recent measurements Waste/landfills (CH_4): EF
New Zealand	-5	-1	-2	-22	Fugitive fuels (CH_4): NS Agriculture: AD, NS
Norway	2	0	2	20	Agriculture (N_2O): M (IPCC), NS
Romania[c]	-7	-2	1	-46	Not reported
United Kingdom	4	0	-1	79	Fuel combustion (N_2O): EF
United States of America	4	0	0	167	Transport (N_2O): M, EF Agriculture (N_2O): NS, M Waste (N_2O): NS Land-use change and forestry (CO_2): M, NS

[a] For purposes of consistency and comparability, emissions of HFCs, PFCs and SF_6, and emissions/removals from land-use change and forestry are not considered in the aggregate GHG emissions values. For Monaco the changes in 1990 estimates are not given in this table since the earlier inventories were incomplete.

[b] This list represents key elements in revisions reported by Parties.

[c] Changes in 1989 (base year) estimates as compared with 1989 estimates provided in the first national communication.

Note: AD: changes in activity data
EF: updated emission factors
M: new methodology
NS: inclusion of new sources

H. Changes in land-use change and forestry estimates

18. Six Parties revised earlier estimates of emissions/removals from land-use change and forestry for the year 1990 compared to estimates provided in second national communications.[20] The largest changes were reported by Australia and the United States of America (see table 3).

Table 3. Changes in CO_2 emission/removal estimates for the land-use change and forestry sector for the year 1990 compared to estimates in the second national communications

Party	Percentage change in CO_2 emissions/ removals in 1990 estimates	Reason for revision	Percentage of aggregate GHG emissions in 1990[a]
Australia	-32	New methodology, changes in activity data: Improvements in methodologies and data collection, in particular for land-clearing, a sector which is subject to high uncertainty. Land-use change and forestry constitutes a net source of emissions, therefore, the negative percentage change denotes that emissions have been revised downwards.	(+)14
France	-9	Reason for revision not reported: the negative percentage change denotes that sinks have been revised downwards, which means less removals in the inventory submission than in the second national communication.	(-)5
Japan	+1	Reason for revision not reported: the positive percentage change denotes that sinks have been revised upwards, which means higher removals in the inventory submission than in the second national communication.	(-)7
New Zealand	+4	Exclusion of source, new methodology: Carbon released from scrub and wildfires is no longer reported; update of planted forest models and data; the positive percentage change denotes that sinks have been revised upwards, which means higher removals in the inventory submission than in the second national communication.	(-)29
United Kingdom	+8	Inclusion of new sources, changes in activity data: inclusion of all land-use transitions (conversion of uncultivated land agriculture and urban use), inclusion of Northern Ireland, inclusion of removal by salt-marshes; improved statistics. This sector constitutes a net source of emissions, therefore the positive percentage change denotes that emissions have been revised upwards.	(+)3
United States of America	+149	Inclusion of new sources, new methodology: CO_2 fluxes have been revised by including new sources, such as forest floor and soil carbon fluxes, as well as estimates related to harvests from public timberlands which had previously not been considered; the positive percentage change denotes that sinks have been revised upwards, which means higher removals in the inventory submission than in the second national communication.	(-)19

[a] Share of CO_2 from land-use change and forestry in aggregate GHG emissions/removals in 1990 as reported in annual inventory submission. Negative values denote that the land-use change and forestry sector constitutes a sink, reducing the Party's aggregate GHG emissions correspondingly when including estimates for this sector; positive values denote that this sector constitutes a net source of emissions, increasing aggregate GHG emissions.

[20] All of these Parties had also revised their estimates in the second national communication, compared to estimates provided in the first national communication.

I. Bunkers

19. Estimates of emissions from international aviation and marine bunker fuels were reported by all Parties but four.[21] Improvements in the data reported have been noted, such as the separate reporting of these emissions without including them in national totals, as requested in the UNFCCC guidelines. Parties also reported the information as two separate entries in their inventories, distinguishing between aviation and marine emissions, with the exception of five Parties[22] which did not use the format of the Revised 1996 IPCC Guidelines.

J. Adjustments

20. All Parties reported unadjusted estimates, as requested by the UNFCCC guidelines. In addition, adjusted CO_2 emission estimates were reported by two Parties, Denmark and the Netherlands, with the aim of excluding disturbances in the CO_2 trend due to outside temperature variations. Denmark also considered variations due to electricity exchange in its adjusted estimates. The Netherlands provided a description of its calculation methods for estimating temperature-corrected CO_2 emissions.

K. Information on activity data and emission factors

21. Parties are required to provide background information regarding activity data, emission factors and other relevant assumptions for the transparency of the inventory. As the new sectoral report tables of the Revised 1996 IPCC Guidelines do not require information on aggregate activity data or on aggregate emission factors, Parties should provide IPCC worksheets to report this information. With the exception of New Zealand, none of the Parties provided worksheets for all sectors in the inventory submissions.[23] The IPCC reference approach using worksheet 1.1 for estimating CO_2 emissions from fuel combustion was provided by nine Parties,[24] although in some cases not for all years for which inventory data were reported, or in an altered format. A few Parties[25] also discussed the differences in the results from the reference and the sectoral approach qualitatively (see annex).

22. Information on activity data, emission factors and methodologies used, were reported or commented by less than two thirds of the reporting Parties. The reporting of this information varied widely among Parties, some of them using the aggregation level of standard data tables for all sectors, while for other Parties this information was limited to specific gases and sectors, such as CO_2 from fuel combustion, and data were given at a very aggregate level. As a result of these differences, both qualitatively and quantitatively, this information is not comparable among Parties.

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[21] Latvia, Monaco, Romania and Spain. Slovakia stated that emissions from bunkers are negligible.

[22] Finland, Hungary, Ireland, Sweden and Switzerland.

[23] Norway and the United Kingdom also provided worksheets, but not as part of their annual inventory submission.

[24] Austria, Norway and Switzerland also submitted the reference approach to the secretariat, but not as part of the annual inventory submission.

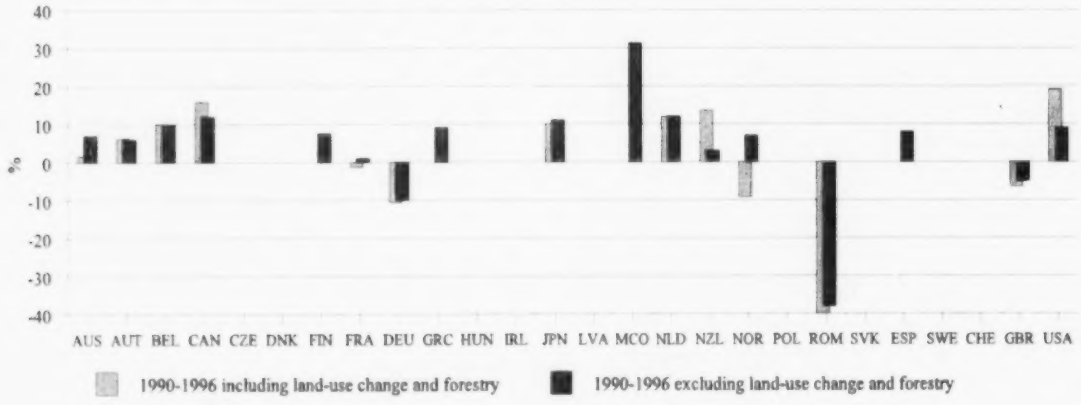
[25] Germany, Greece, the United Kingdom and the United States of America.

III. EMISSION TRENDS AND SOURCES

A. Trends in greenhouse gas emissions

23. The following GHG emission trends for the period 1990-1996 have been identified, based on information provided by 17 Parties which submitted inventory data for the time series 1990 to 1995/1996.[26] For those Parties reporting data only for the year 1996 no analysis of trends was made, as it was not clear whether the 1996 estimates were consistent with those provided in second national communications.

Figure 1. Percentage change in GHG emissions, 1990-1996



Note: For Japan, Romania and Spain, changes are for 1990 to 1995, 1989 to 1994, and 1990 to 1995, respectively, as 1996 estimates were not fully provided.

24. Greenhouse gas emissions (excluding land-use change and forestry) increased in 1996 compared to 1995 levels for all reporting Parties. The increase in emissions for the period 1995-1996 was larger than the average annual increase in emissions over the period 1990-1995. There was an increase in emissions over the period 1990-1996 (excluding land-use change and forestry) for all Annex II Parties (see figure 1), with the exception of Germany and the United Kingdom,[27] which reported a decline in emissions over the 1990-1996 period. Inclusion of the land-use change and forestry sector[28] does not alter the increasing trend in emissions, except for France and Norway for which emissions also decreased over the 1990-1996 period after

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[26] Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Monaco, Netherlands, New Zealand, Norway, the United Kingdom and the United States of America. Where data are available, Japan, Romania and Spain have also been considered, using 1995 data for Japan and Spain, and 1994 data for Romania. For the analysis of emissions from 1995 to 1996, Hungary, Ireland and Slovakia have also been included as they provided data for these years.

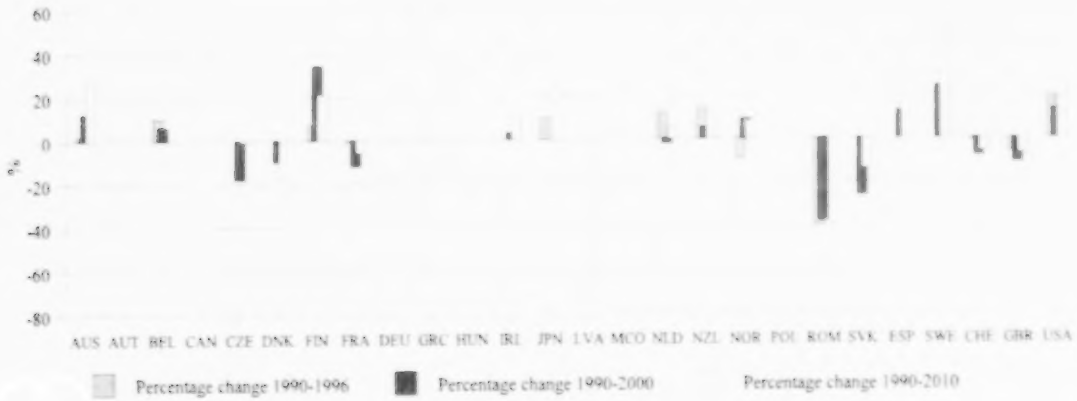
[27] For these Parties the decline in emissions was 10 and 5 per cent from 1990 to 1996, respectively, while from 1995 to 1996 emissions rose for both these Parties by 2 and 3 per cent, respectively.

[28] Emissions/removals from land-use change and forestry have been aggregated to emissions from the other sectors in accordance with the present IPCC Guidelines for National Greenhouse Gas Inventories. It should be noted that the way of aggregating estimates from the land-use change and forestry sector to the other sectors may change after completion of the methodological work by IPCC and the adoption of the corresponding conclusions by the SBSTA.

inclusion of land-use change and forestry removals.[29]

25. Projections for the year 2000, including the land-use change and forestry sector, indicate an increasing trend in GHG emissions as compared with base year levels for eight Parties, while another eight Parties projected a decrease (Czech Republic, Denmark, France, Netherlands, Romania, Slovakia, Switzerland and the United Kingdom) (see figure 2).

Figure 2. Percentage change in GHG emissions (including land-use change and forestry), 1990-1996 and projected percentage change for 2000 and 2010.

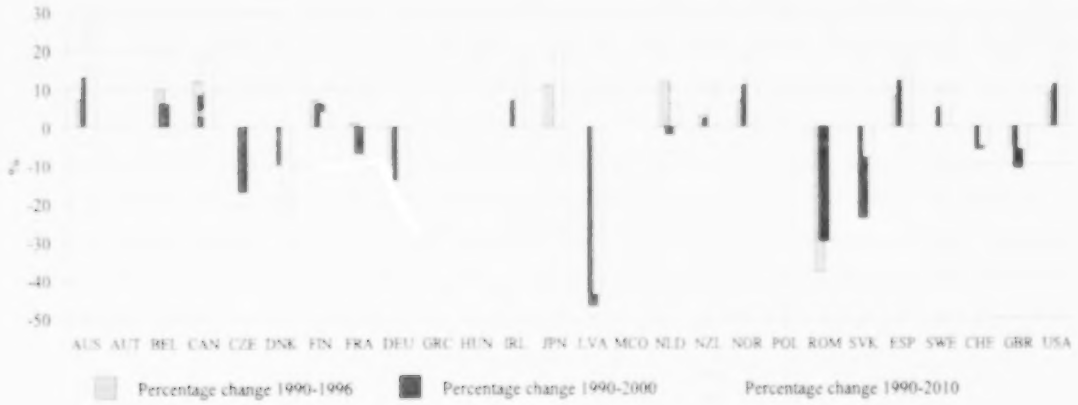


Note: Austria, Canada, Germany, Greece, Hungary, Monaco and Poland did not present projections in the land-use change and forestry category, and therefore are not included here.

26. Projections of GHG emissions, excluding the land-use change and forestry sector, exhibit similar results, although for some Parties the projected percentage increases or decreases differ substantially from projections including the land-use change and forestry sector, e.g. Ireland (see figure 3).

[29] For these Parties the decline in emissions from 1990 to 1996 including land-use change and forestry was 1 and 9 per cent, respectively.

Figure 3. Percentage change in GHG emissions (excluding land-use change and forestry), 1990-1996 and projected percentage change for 2000 and 2010



Note: Austria, Greece, Hungary, Monaco and Poland did not present projections for all three main GHG (CO_2, CH_4 and N_2O), and were therefore not included here. Belgium provided projections for all GHGs until 2005, and Japan for 2010 only. The Czech Republic and France projected aggregate GHG emissions to be at 1990 levels in 2010.

B. Trends by gas and sector

27. Trends in CO_2 emissions closely follow the increasing trend in GHG emissions, both for the period 1995-1996 and for 1990-1996.[30] CO_2 emissions from fuel combustion, which constitutes the most important source of CO_2 emissions for all Parties, increased for all Parties over the 1990-1996 period, except for Germany and the United Kingdom (see table 4).

28. CH_4 emissions dropped from 1990 to 1996 for all Parties except Canada, Greece, Norway, Spain[31] and the United States of America. Between 1995 and 1996 such emissions continued to decline or remained stable, with the exception of Canada and Hungary. The individual source categories displayed different trends to that of total CH_4 emissions from 1990 to 1996. Emissions from agriculture generally declined, except for those Parties reporting increasing total CH_4 emissions. Recent trends show a decline in agricultural emissions for all Parties except Ireland. For fugitive fuel emissions, there is an increasing trend, except for Norway. Emissions from the waste sector, although generally increasing, have remained stable or now show a decline for all Parties except for Australia, Slovakia and the United States of America.

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[30] As in the case of aggregate GHG emissions, Germany and the United Kingdom reported a decline in CO_2 emissions over the 1990-1996 period. Since 1995, CO_2 emissions have risen for both.

[31] Period 1990 to 1995.

Table 4. Percentage change in GHG emissions by gas, 1990-1996

	Decrease		Percentage change between + 1 and - 1 %	Increase	
	5 % or more	1 to 5 %		1 to 5 %	5 % or more
Aggregate GHG (including *land-use change and forestry*)	Germany, Norway Romania,[a] United Kingdom		France (-1)	Australia	Austria, Belgium, Canada, Japan,[b] Netherlands, New Zealand, United States of America
Aggregate GHG (excluding *land-use change and forestry*)	Germany, Romania[a]	United Kingdom	France (+1)	New Zealand	Australia, Austria, Belgium, Canada, Finland, Greece, Japan,[b] Monaco, Netherlands, Norway, Spain,[c] United States of America
CO_2	Germany, Romania[a]	United Kingdom		Austria, France	Australia, Belgium Canada, Finland, Greece, Japan, Monaco, Netherlands, New Zealand, Norway, Spain,[c] United States of America
CH_4	Belgium, Finland, France, Germany, Netherlands, Romania,[a] United Kingdom	Austria, Japan,[b] New Zealand	Australia (-1)	Greece, United States of America	Canada, Norway, Spain[c]
N_2O	Romania,[a] United Kingdom	France, Greece, Spain[c]	Finland (-1), Germany (+1), New Zealand (+1), Norway (0)	Australia, Japan[b]	Austria, Belgium, Canada, Netherlands, United States of America
HFCs, PFCs, SF_6	**Decrease**		**Increase**		
	50 % or more	**5 to 20 %**	**10 to 50 %**	**50 to 100 %**	**100 % or more**
	Australia, Norway	Canada, France, New Zealand	Germany, Netherlands, United Kingdom	Finland, Japan, United States of America	Belgium, Greece

[a] Changes are for 1990 to 1994.
[b] Changes are for 1990 to 1995, as no CH_4 and N_2O estimates were provided for 1996.
[c] Changes are for 1990 to 1995.

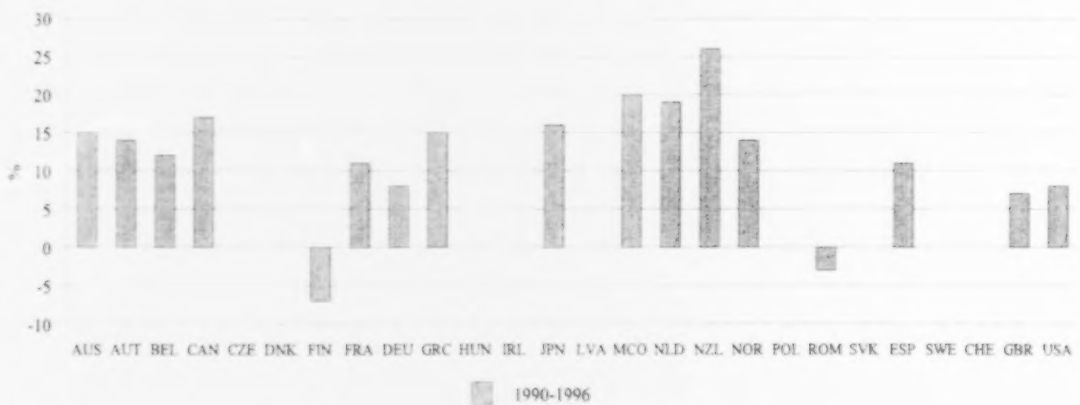
29. For N_2O no common pattern in trends is apparent over the period 1990-1996; N_2O emissions increased for approximately half of the reporting Parties. From 1995 onward, they increased for all reporting Parties, except for Australia, Austria, Ireland and New Zealand, where they decreased slightly or remained stable at 1995 levels. Emissions from agricultural sources of N_2O dropped or remained stable from 1990 to1996 for all but three Parties (Canada, Netherlands, the United States of America), as was the case for N_2O emissions from industrial processes (except Belgium, Canada, Germany, the United States of America). By contrast, N_2O emissions from fuel combustion, particularly from transport, increased for all Parties. However, N_2O emissions from transport in 1996 remained at 1995 levels for Austria, Belgium, Finland, Ireland, Norway and the United States of America.

30. HFC emissions increased sharply from 1990 to 1996, while PFC emissions declined for all Parties over the period 1990-1996, except for Japan and the United States of America. Emissions of SF_6 increased for all Parties except Canada and Norway. Information on these gases is rather uncertain, in particular for those Parties which provided the information in full mass of the gases without disaggregation by species, as the secretariat had to make certain assumptions as to the species of the gases in order to calculate CO_2 equivalents. Differences between actual and potential emissions can be large,[32] which has significant implications for aggregate GHG emissions.

C. Trends in the transport sector

31. Transport continues to be the fastest growing source of GHG emissions, accounting for 38 per cent of the overall increase in emissions for the period 1990-1996 of the 17 Parties considered, and is the second largest source of aggregate GHG emissions (figure 5). For countries with economies in transition the relative share of transport emissions was below 10 per cent, while for Annex II Parties the share of transport emissions ranged from 10 to 33 per cent. Over the period 1990-1996, emissions from transport increased for all Parties except Finland (-7 per cent). Since 1995, emissions from this sector have continued to increase, except for Finland, Hungary, Monaco and Slovakia, and for Germany, for which transport emissions have remained at 1995 levels. In Austria, France and New Zealand the increase in transport emissions from 1995 to 1996 was less than in previous years. Increases in emissions from transport of about 5 per cent from 1995 to 1996 were reported by Ireland, the Netherlands and Norway (see figure 4).

Figure 4. Percentage change in transport emissions, 1990-1996



Note: For Japan, Romania and Spain, changes are for 1990 to 1995, 1989 to 1994, and 1990 to 1995, respectively, as 1996 estimates were not fully provided.

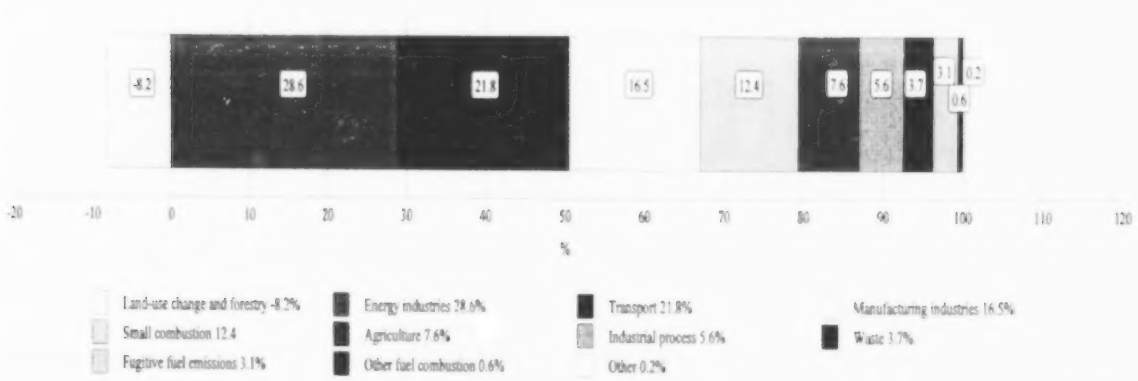
[32] Examples of the ratio of potential to actual emissions based on estimates provided in second national communications are given in document FCCC/SBSTA/1998/7, table 25.

D. Major sources of emissions

32. In 1996, CO_2 accounted for 81 per cent of GHG emissions, expressed in CO_2 equivalent (excluding land-use change and forestry). CH_4 and N_2O represented 10 and 6 per cent of total emissions, respectively, while emissions of HFCs, PFCs and SF_6 taken together accounted for a share of 2.1 per cent. However, the share of HFCs, PFCs and SF_6 could be overestimated as actual emissions of these gases were not provided by all Parties. The relative share of each gas did not change significantly from 1990 to 1996, with the exception of that of HFCs, PFCs and SF_6. CO_2 was the most important GHG for all Parties in 1996, except for New Zealand, for which CH_4 was the most significant. HFCs, PFCs and SF_6 had an important share for Greece, Japan, the Netherlands and Norway.[33]

33. The fossil fuel combustion sector as a whole accounted for 80 per cent of all GHG emissions, and, with the inclusion of fugitive fuel emissions, the whole energy sector accounted for 83 per cent of the emissions. For 1996, the energy industries were the largest single source of GHG emissions for the Parties considered, accounting for approximately 29 per cent of all GHG, followed by transport, which was responsible for 22 per cent of the emissions. Inclusion of the land-use change and forestry sector, which constituted a net sink for the Parties, reduces aggregate emissions by 8 per cent. No significant change took place in the distribution of the major sources of emissions in 1996 compared with 1990. It should be recognized that the shares of the single source categories given here may not be representative of all Annex I Parties as a group, as they do not take into account some Parties with economies in transition such as the Russian Federation and the Ukraine, which contribute significantly to the aggregate Annex I Party emissions (see figure 5).

Figure 5. Share of aggregate GHG emissions by major sources, 1996

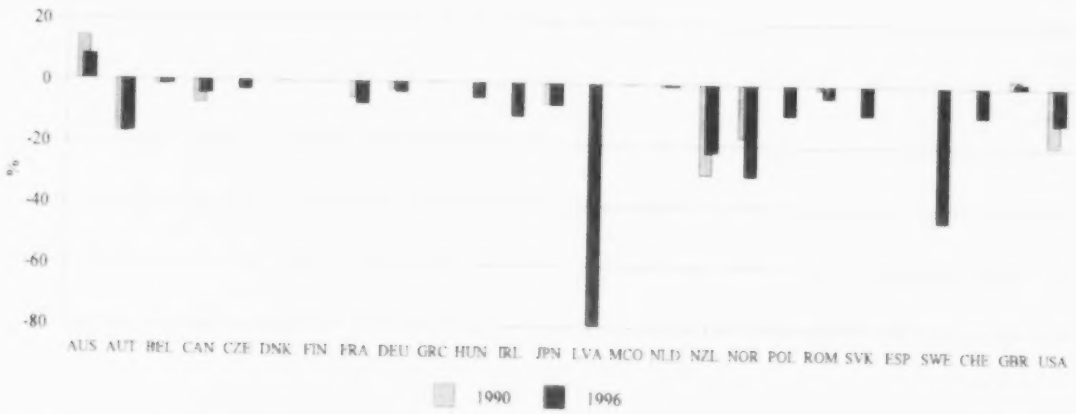


[33] For these four Parties the relative share of HFCs, PFCs and SF_6 was 3.6, 7.5, 4.5 and 3.5 per cent of aggregate GHG emissions, respectively.

E. Land-use change and forestry

34. The land-use change and forestry sector constituted a net sink for all Parties except Australia and the United Kingdom, and removals accounted for about 8 per cent of aggregate GHG emissions for the Parties considered. The *changes in forest and other woody biomass stocks* was the most important subcategory reported, constituting a sink for all Parties. Net CO_2 removals were equivalent to more than 10 per cent of aggregate GHG emissions for seven Parties (Austria, Ireland, Latvia, New Zealand, Norway, Sweden and the United States of America), reducing aggregate emissions correspondingly when including estimates from this sector. The size of the sinks increased over the period 1990-1996 for all Parties except Canada, New Zealand and the United States of America. Since 1995 all Parties except Hungary reported an increase or stabilization of CO_2 removals from land-use change and forestry (see figure 6).

Figure 6. Share of net CO_2 removals or emissions from land-use change and forestry as a percentage of aggregate GHG emissions, 1990 and 1996



Note: For Finland, Greece, Monaco and Spain, estimates for land-use change and forestry were not available. In the case of Denmark, the share of land-use change and forestry was close to zero. For Japan and Romania, estimates given here are for 1995 and 1994, respectively.

F. International bunkers

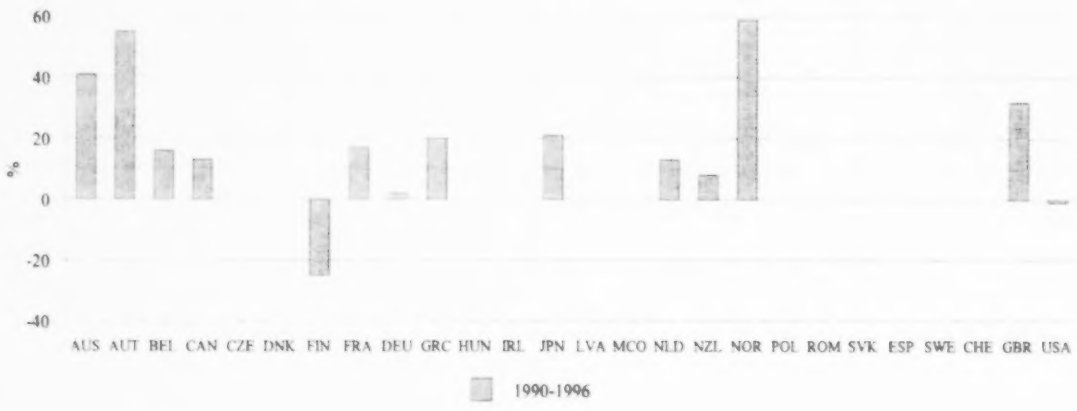
35. Greenhouse gas emissions from international bunker fuels, although not accounted for in national GHG emissions, were in general equivalent to between 1 and 10 per cent of Parties' aggregate 1996 GHG emissions, and between 3 and 25 per cent of aggregate transport emissions. For Belgium, Denmark, Greece, the Netherlands and Norway, bunker emissions constituted a significantly higher share of emissions than for the rest of the Parties (see box 5).

Box 5. Share of bunkers in aggregate GHG and transport emissions, 1996

	Percentage of aggregate 1996 GHG emissions	Percentage of aggregate 1996 transport emissions
Australia	2.0	12.8
Austria	1.7	8.5
Belgium	12.0	79.8
Canada	0.9	3.1
Czech Republic	0.3	4.4
Denmark	7.6	58.3
Finland	3.1	20.7
France	3.2	13.2
Germany	1.8	11.1
Greece	11.1	71.9
Hungary	1.1	12.6
Ireland	2.7	23.8
Japan (1995)	2.8	15.2
Latvia		
Monaco		
Netherlands	18.8	127.5
New Zealand	3.5	23.1
Norway	56.0	207.8
Poland	0.5	7.4
Romania		
Slovakia		
Spain		
Sweden	6.8	24.0
Switzerland	4.6	16.1
United Kingdom	4.0	22.8
United States of America	1.3	4.9

36. Emissions from international bunkers increased for all Parties except Finland and the United States of America over the period 1990-1996, in some cases up to more than 50 per cent over 1990 levels (Austria, Norway). Data for the period 1995-1996 shows a sharp change in these emissions for some Parties: an increase for Finland, and a decline for Greece, Japan, New Zealand and the United States of America. For Germany bunker emissions remained at 1995 levels (see figure 7).

Figure 7. Percentage change in aggregate bunker emissions, 1990-1996



Annex

STATUS OF INFORMATION REPORTED BY PARTIES IN ANNUAL INVENTORY SUBMISSIONS, 1996

Party	Hardcopy (H) Eletronic (E)	Period	Reporting		Use of 1996 IPCC tables			Use of other format[c]	IPCC Reference approach, worksheet 1-1
			HFCs, PFCs, SF_6[a]	Precursors & SO_2	summary	sectoral	overview		
Australia	E, H	1990-1996	X (no HFCs)	X	X	X[b]	X		
Austria	H	1990-1996	X	X				X	(X)[d]
Belgium	E, H	1990-1996	X	X	X (1995 & '96)	X (1995 & '96)			
Canada	H	1990-1996	X	X (1995 only)	X	X	X (96)		X (1996 only)
Czech Republic	E	1996	X	X	X	X			value only
Denmark	E, H	1996	X	X	X	X			
Finland	H	1990	X				X	X	X
France	E	1990-1996	X	X	X	X[b]			
Germany	E, H	1990-1996	X	X	X				X (1990-94)
Greece	H	1990-1996	X (no SF_6)	X	X	X			X
Hungary	E	1991-1996		X (no SO_2)				X	X
Ireland	H	1995-1996		X (1995 only)				X	
Japan	E	1990-1996	X	X	X	X			value only
Latvia	H	1996		X				X	
Monaco	E, H	1990-1996		X				X	
Netherlands	H	1990-1996	X	X				X	
New Zealand	E, H	1990-1996	X	X	X	X	X		X
Norway	E, H	1990-1996	X	X	X	X (no LUCF)	X		(X)[d]
Poland	H	1996	X (no SF_6)	X (no SO_2)	X				
Romania	E, H	1989-1994		X				X[c]	
Slovakia	H	1995, 1996	X (PFCs only)	X				X[c]	X (incomplete)
Spain	H	1990-1995		X				X	
Sweden	E, H	1996		X (no SO_2)			X	X	
Switzerland	E, H	1996	X	X		X	X	X	(X)[d]
United Kingdom	E, H	1990-1996	X	X	X	X	X		X
United States of America	E, H	1990-1996	X	X	X (1996 only)	X[b] (1996 only)	X	X (for 1990-1995)	X (in MMTCE)

Note: **LUCF** = land-use change and forestry **MMTCE** = million metric tons of carbon equivalent

[a] For further details on the reporting of HFCs, PFCs and SF_6 see table 1. An "X" in this column does not give any indication as to the reporting of actual or potential emissions, or disaggregated reporting by gas species.

[b] Sectoral report table for land-use change and forestry has been modified.

[c] "Other formats" refer to tables similar to the 1996 IPCC summary/sectoral tables, such as summary tables from the previous version of the IPCC Guidelines, tables using the IPCC categories but structured differently (e.g. by trends of individual gases), or tables providing specific source categories at a more disaggregated level than required in the IPCC summary table.

[d] Austria, Norway and Switzerland also provided a reference approach, but not as part of their annual inventory submission.

[e] It should be noted that the SBSTA at its fourth session decided that Parties with economies in transition are allowed to phase in the Revised 1996 Guidelines for the inventories due in 1999.

(continued)

STATUS OF INFORMATION REPORTED BY PARTIES IN ANNUAL INVENTORY SUBMISSIONS, 1996

LUCF worksheets or equivalent documentation	Other 1996 IPCC worksheets	IPCC standard data tables	Indication of methods[f]	Source of activity data (AD) & emission factors (EF) referenced	Indication of uncertainty[g]	Use of Notation keys (NE, NO, IE)[h]	CO_2 equivalent estimates (Gg)	Party
X		X (1996)	X	(X)	X	X	X	Australia
			(X)	For energy (AD) only			X	Austria
			(X)	For energy			X	Belgium
			X	X	(for LUCF only)			Canada
								Czech Republic
								Denmark
			X	X	X	Partially	X	Finland
			X	For CO_2 energy only			X	France
					X	X	X	Germany
			X	X	X		X	Greece
X			(X)	For energy & agriculture		Partially		Hungary
								Ireland
								Japan
							X	Latvia
n.a			(X)	For EF				Monaco
			X	X	X		X	Netherlands
X	X		X	X	X	X		New Zealand
	(X)[i]		X	X	X	X	X	Norway
								Poland
			(X)	(X)			X	Romania
Tables similar to standard data tables		X (not all sectors /gases)	(X)	X				Slovakia
								Spain
Standard data tables		X (not all sectors /gases)		For AD		Partially		Sweden
X			(X)	X	X			Switzerland
Standard data tables	(X)[i]	X	X	X	X	X		United Kingdom
			X	X	X	X	(in MMTCE)	United States of America

[f] An "X" in this column indicates that information on methodologies was provided, while "(X)" indicates that methodologies were only briefly commented on or referenced, or that information on methodologies was not given for all gases and / or sectors.

[g] This column refers to information which is provided in addition to the 1996 IPCC overview table.

[h] Notation keys to be used in IPCC summary and sectoral tables. NO = not occurring, NE = not estimated, IE = estimated but included elsewhere.

[i] Norway and the United Kingdom also provided worksheets, but not as part of their annual inventory submission.

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